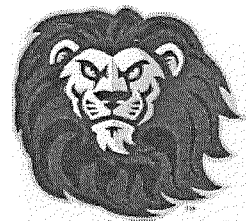
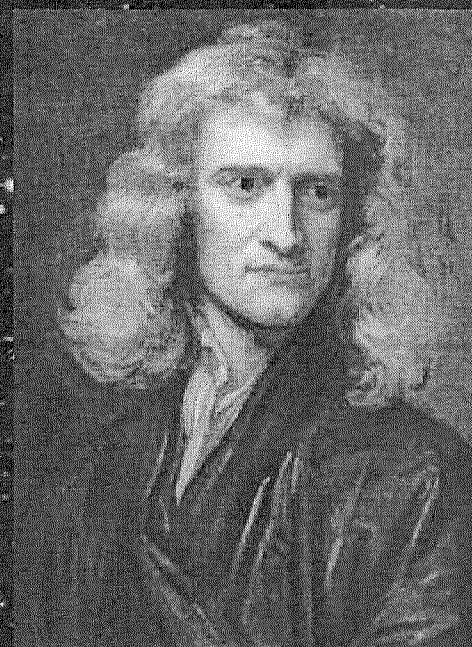
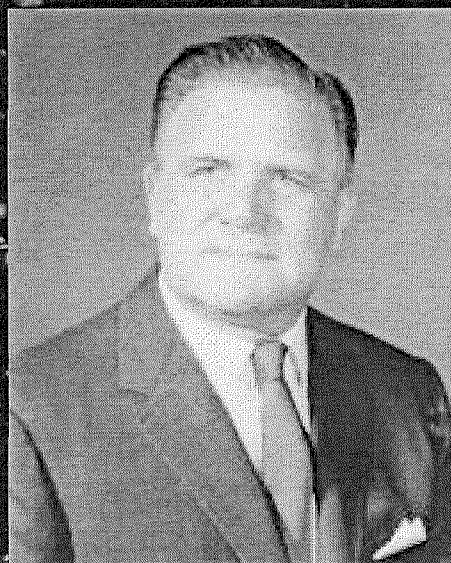


Systems Integration Programs

The Role of Subcontracts in Assessing and Managing Suppliers

By:
Salvatore Achille Petrelli
April 24, 2007





AGENDA

- ☐ Today's Industry
- ☐ Subcontracts Lifecycle
- ☐ Subcontract Management Team
- ☐ The Selection & Management
- ☐ Case I: Poor Supplier Assessment
- ☐ Case II: Six Sigma Findings
- ☐ Technology Readiness Level
- ☐ Mismanaged Acquisition Process
- ☐ Problem's Today
- ☐ Conclusion

GTE Government Systems
 National Steel and Shipbuilding Company
 Computing Devices International
 Lockheed Martin Armament Systems
 Lockheed Martin Defense Systems
 Teledyne Vehicle Systems
 FC Business Systems
 Advanced Technical Products
 Motorola's Integrated Information Systems Group
 Anteon International
 Lucent
 Bath Iron Works
 Gulfstream Aerospace
 Steyr Daimler Puch Spezialfahrzeug
 Datron's Intercontinental Manufacturing Company
 Digital Systems Resources
 Veridian
 Galaxy Aerospace Company
 GM Defense
 Spectrum Astro

NORTHROP GRUMMAN



BOEING

MCDONNELL DOUGLAS



Rockwell International

Comptek Research Federal Data Corporation
 Navia Aviation As
 Inter-National Research Institute
 California Microwave
 Sterling Software
 Westinghouse Electronic Systems Group
 Newport News Shipbuilding



Logicon

Litton

Data Procurement Corporation

Syscon Corporation



Geodynamics Corporation

Raytheon

Teledyne Ryan

BRITISH AEROSPACE



LOCKHEED MARTIN

Martin Marietta

Delco Electronics
 E-Systems
 TEXAS INSTRUMENTS



Loral Corporation

GENERAL DYNAMICS
 MISSILE

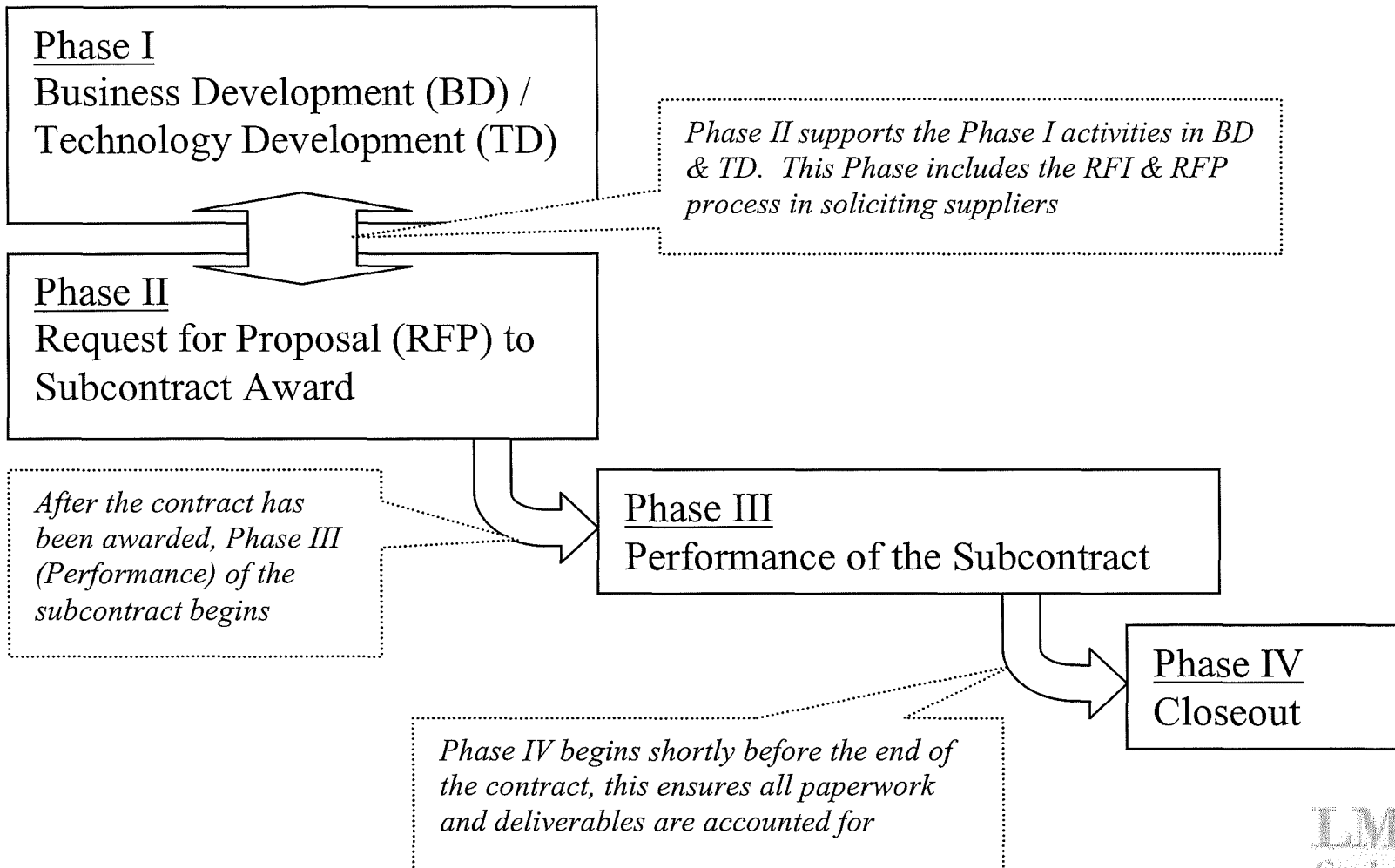


GENERAL DYNAMICS
 Magnavox Electronic Systems

LMU/LA
 Graduate Division

The Subcontract Lifecycle

Subcontract Life Cycle



Program Life Cycle

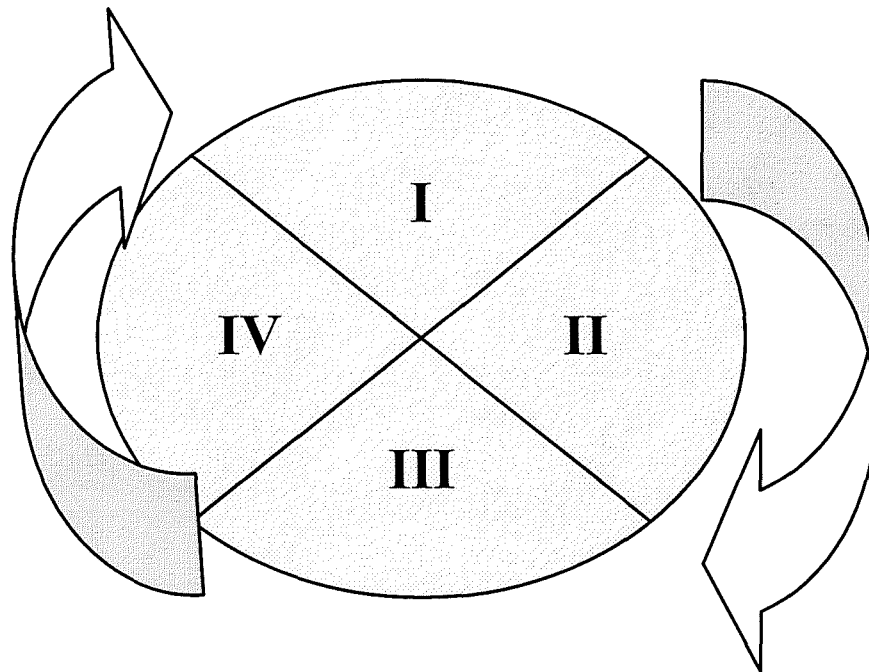
CDR

PD

DD

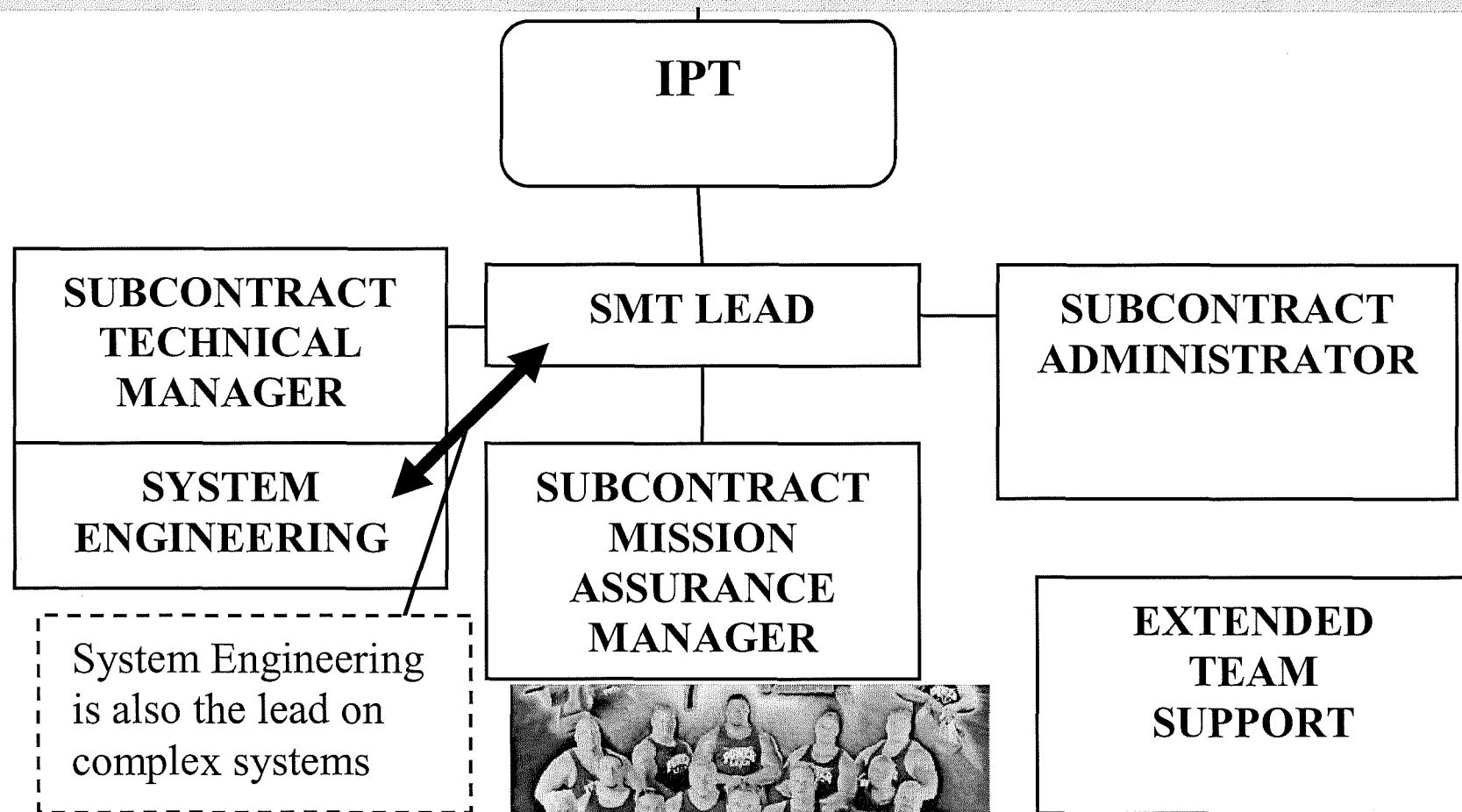
DP/C

Ou & SS



No
Correlation

Subcontract Management Team

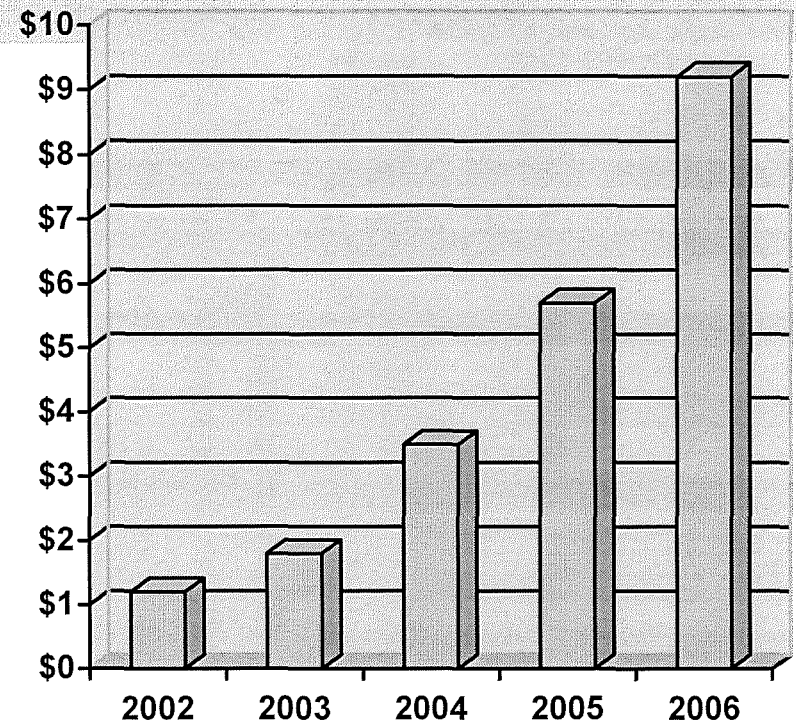


Supplier Assessment

- Invite new subcontractor candidates to visit the prime's facility and demonstrate/present their qualifications
- Review available subcontractor data from prior programs
- Supplier Directory
- Prior Engineering, Quality Assurance, and Performance Surveys
- Acquisition Data Center Records
- Subcontractor Performance Report Cards
- Subcontractor Engineering Capability Assessments
- Dunn & Bradstreet report
- Understand Supplier DNA

Case of the Poor Supplier Assessment

- Subcontract value delta increases are primarily due to:
 - Late requirement definition
 - Customer driven new scope
 - Quality and test failures driving spec changes, repairs and re-works
- X has not been in good financial straights from the very beginning
 - the selection criteria did not analyze X' financial health before the subcontract was awarded
- X financial position handicapped its ability to adjust to audible(s)
- X did not have the resources to apply in time of crisis



Phase III - Performance

PRIME



- Requirements Management



- Configuration Management



- Data Management



- Interface Management



- Lessons Learned

SUBCONTRACTOR

The Six Sigma Team



Dave Orlando

Marcia Wilson

Sammy Petrelli

Michael Narigon

Steve Hixson

Ray Crew (not pictured)

Problem Statement

- This project was initiated to address the performance (mainly cost) issues associated with the major sensors, their aggregate Cost Performance Index was .90: this represented vast inefficiencies with our major suppliers.

The Six Sigma Process

D

Define the Problem

aggregate Cost Performance Index was .90: this represented vast inefficiencies with our major suppliers

M

Measure

104 parameters were identified
10 major Acquisition managers were interviewed

A

Analyze

Used Minitab to run Regression tests; Identified 3 key correlations
TRL, Level of BOE, and Number of IBR Findings

I

Improve

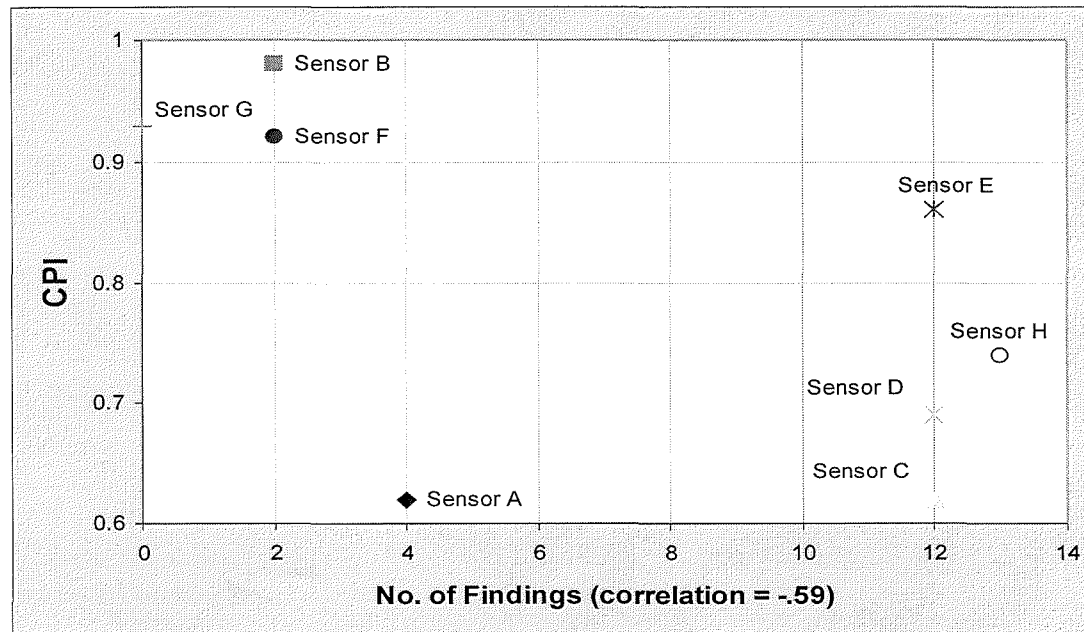
Update relevant manuals and implemented training

C

Control

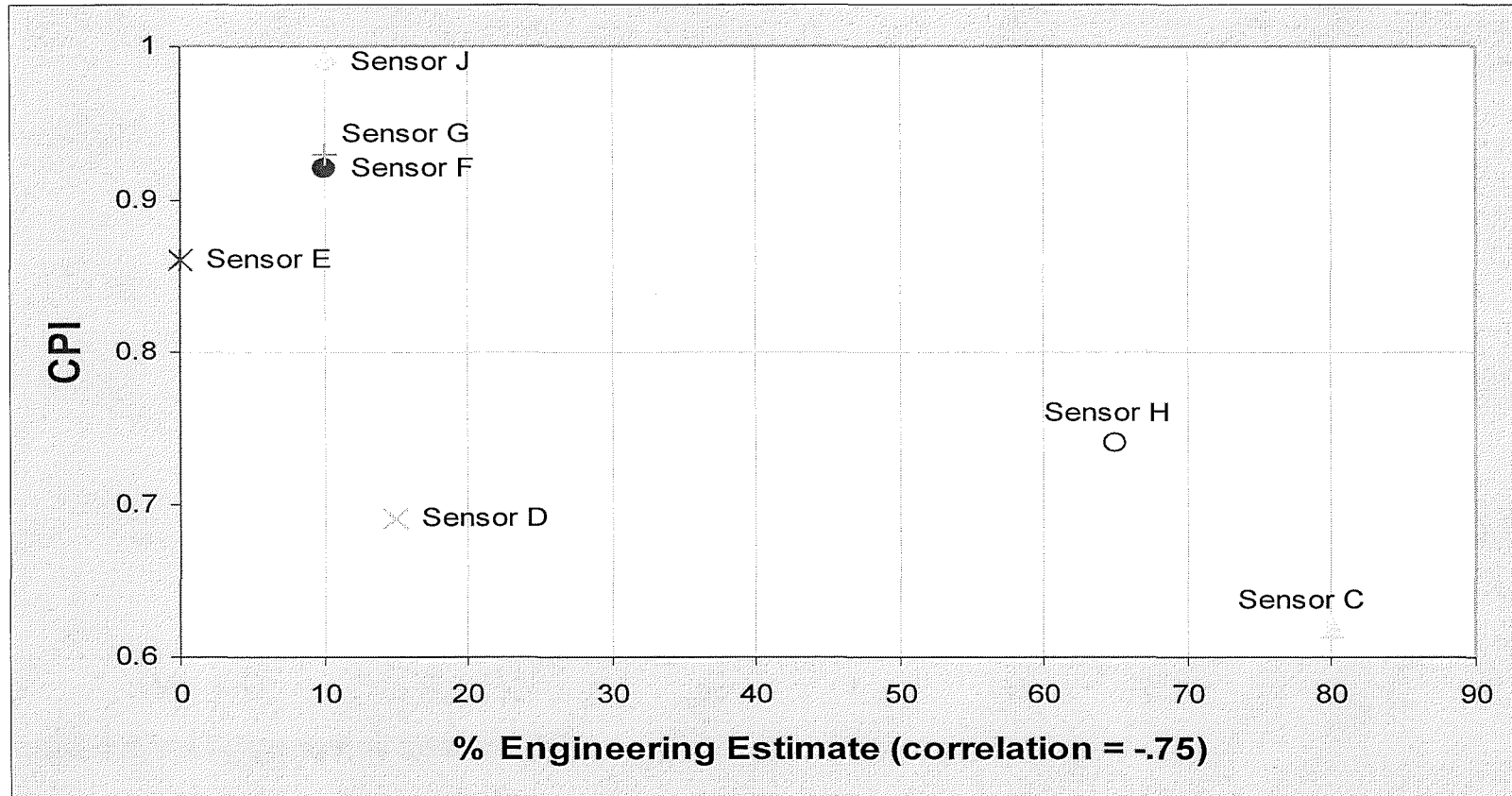
Metrics were established as well as an auditing process

Integrated Baseline Review



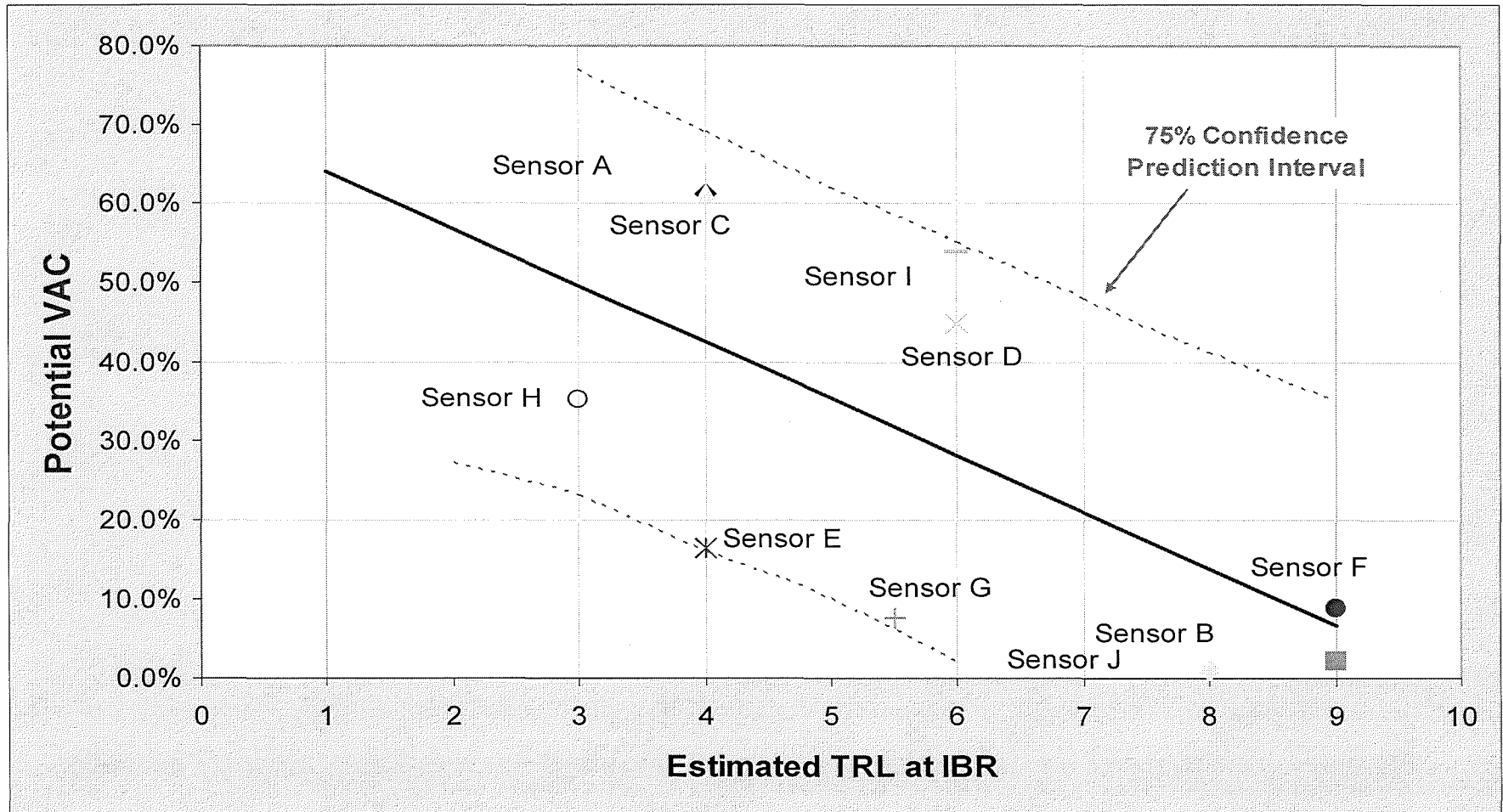
- Data suggests the Number of IBR findings as a potential Tripwire
 - No. of findings may be indicator of systemic issues, beyond just needing the action items answered

Basis of Estimate



- BOE detail may be a predictor of cost performance
 - Level 5 may be the right target

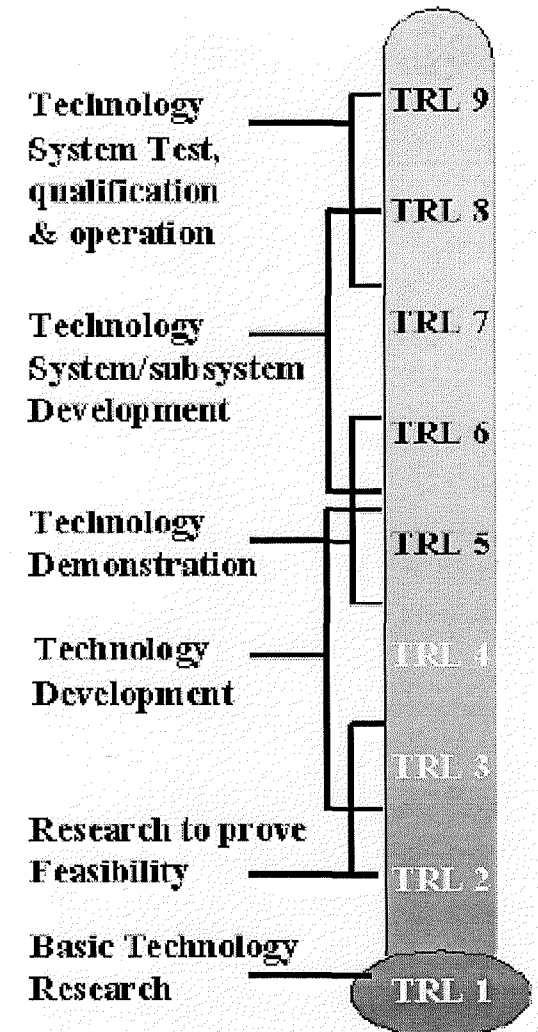
TRL As A Predictor of Cost Risk



Forecast VAC assumes TCPI = ITD CPI for current subcontracts

Technology Readiness Level

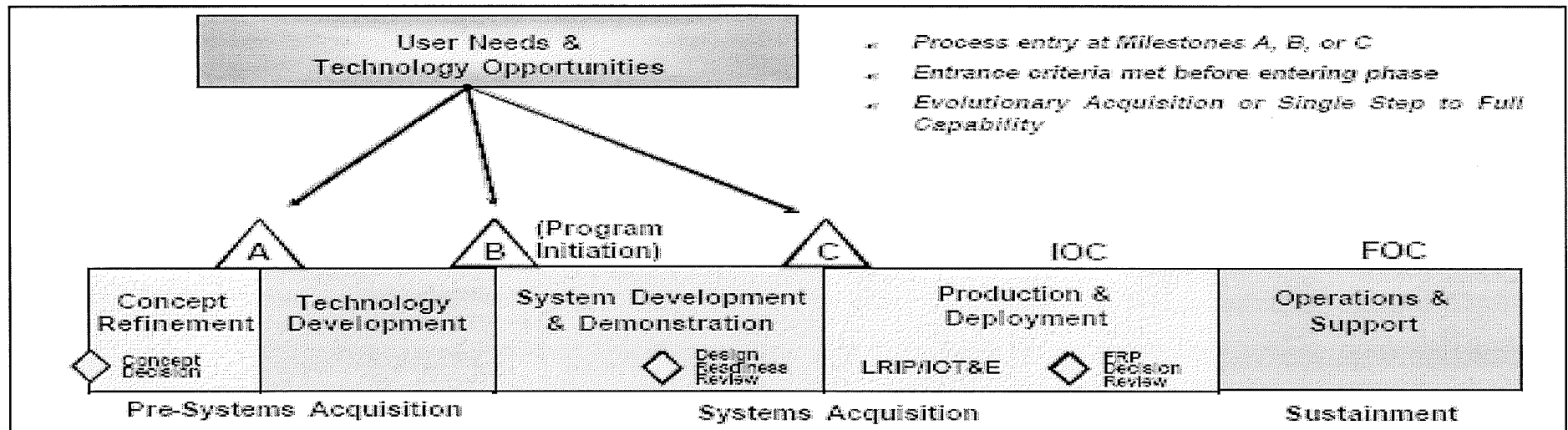
- Technology maturity is a measure of the degree to which proposed critical technologies meet program objectives; and, is a principal element of program risk.



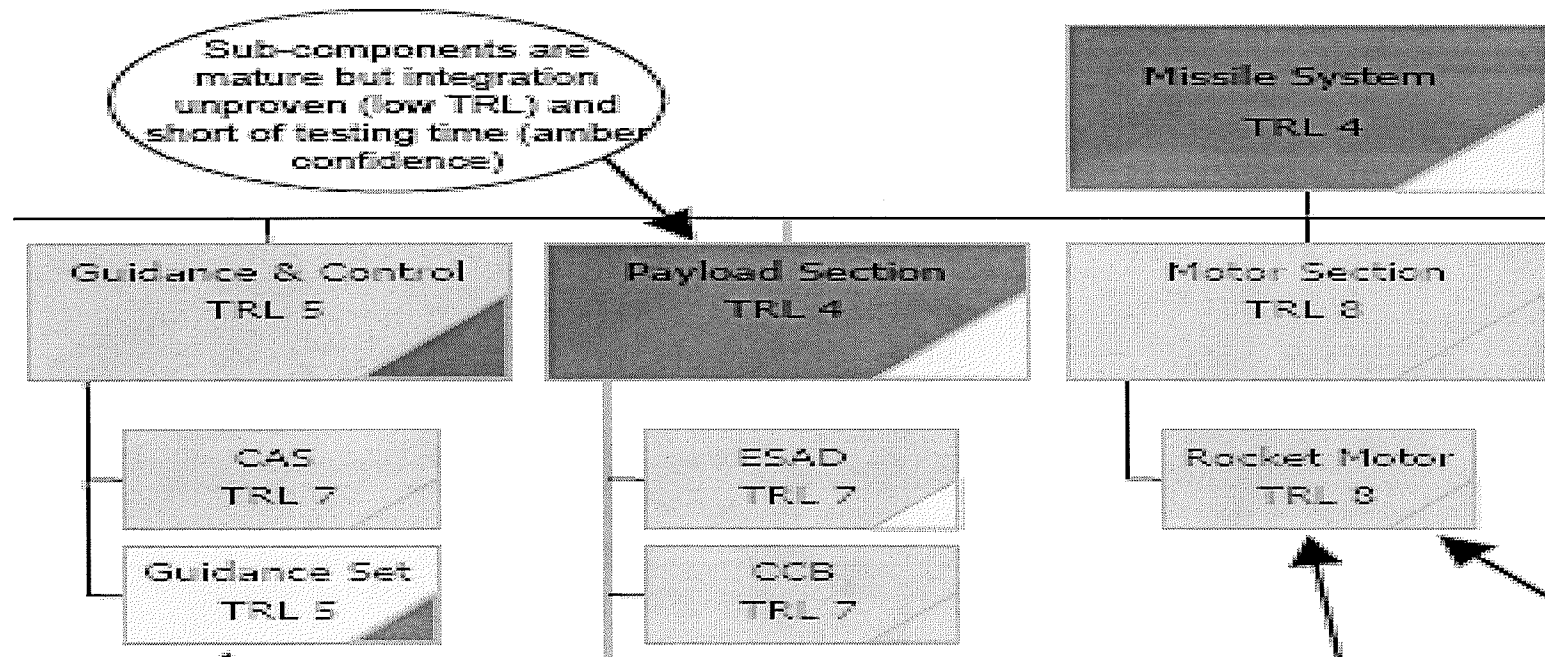
TRL Levels

- TRL9: Actual technology system qualified through successful mission operations.
- TRL8: Actual technology system completed and qualified through test and demonstration.
- TRL7: Technology system prototype demonstration in an operational environment.
- TRL6: Technology system / subsystem model or prototype demonstration in a relevant environment.
- TRL5: Technology component and/or basic technology subsystem validation in relevant environment.
- TRL4: Technology component and/or basic technology subsystem validation in laboratory environment.
- TRL3: Analytical and experimental critical function and/or characteristic proof-of-concept.
- TRL2: Technology concept and/or application formulated.
- TRL1: Basic principles observed and reported.

TRL's Insertion



Technology Breakdown Structure



Additional Common Factors

“Good” Performers

- Non-competitive S/K
 - Already teammate or selected supplier at time of prime contract award
 - High probability of realism vs. price-to-win

“Poor” Performers

- Highly competitive environment for Prime at time subs negotiated
 - Accepted success-oriented bids, overlooked risk to keep program sold
- Low product design maturity
 - Even though some had high TRL
- Overstated heritage
 - Either not recognized by Prime, or Prime accepted risk
 - Minimal cost reserves & schedule slack
- Funding profiles that changed year-to-year
- Acquisition Managers forget who they are working for

Need for “Trip Wires”

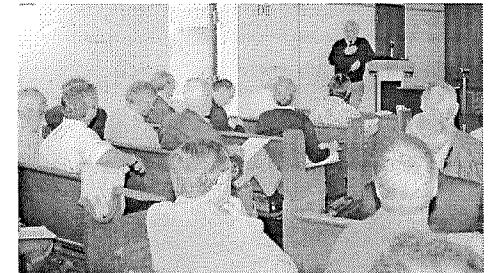
- Typically, we assume that a subcontractor will “be like us”, problems surface, we wait too late to become “intrusive”
- Problem surface early in two areas: ability to manage cost and schedule and ability to follow a disciplined design review process
- Two early events in the life of a subcontract allow the prime insight into the adequacy of a subcontractor’s processes
 - IBR
 - SRR or PDR
- Measurable, unambiguous entry and exit criteria must be established for these events
 - Supported by our specialists in these areas
 - Defined course of action in the event of failure
 - Don’t be timid about piling on resources to fix early (sometimes Managers forget who they work for)
 - Cheaper to “pay me now” rather than “pay me later”
 - Prime is only as good as the weakest subcontractor process

[illegible]

- LMU LA
Graduate Division

Need for “Intrusive” Design Review Process

- When we do have problems with subcontractors, the statement is made after the fact that we didn’t “dig deeply enough in their design review”
- Must get the most qualified non-advocates to review the subcontractor’s design
 - If expertise does not exist within, get experts from outside the company
 - Non-advocates must spend the time they need with the subcontractor’s design personnel to understand the design –
 - not a two-day “dog and pony” show
- Consider parallel design analysis
- Fund engineering models
- We must not add to the problem by flowing down TBD’s
 - Even if we’re not sure on a particular requirement, pick a value that’s close
 - Probably less impact than leaving it TBD



Know Your Subcontractor

- Team building is hard and takes time
 - Knowing your team-mates strengths (and weaknesses) can greatly reduce risk and save money
- Don't assume the subcontractor is like you
 - Most likely, they're not
- Make sure expectations are known in both directions
- Work through the IPT structure
 - It provides reach into their organization
- Need to understand the subcontractor goes up considerably if the subcontractor is providing you with a product and service
 - Product-only subcontract is more transactional and measurable
 - Product and service subcontractor is more relational and can be difficult to measure and control

Voice of PM's: What They Would've Done Differently

- Program B
 - “Compete the work with a comprehensive RFP
 - “Identify and resolve key issues
 - “Write a good contract
 - “Incentivize good behavior through the contract
 - “Write complete specs; identify problems early via IBR & SRR
 - “Take corrective action early
 - “Build Engineering Models”
- Program C
 - “Improve CDR detail – dig in more deeply
 - “More Prime/sub-contractor interface
 - “Determine sub-contractor weakness early
 - “Generate recovery plan
 - “Re-bid some parts of the subcontract”

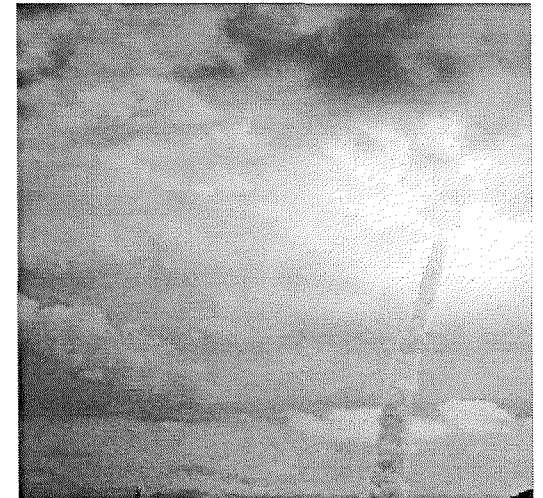
Instructions to Program Manager

How to Recommend

- Learn as much as you can, in advance, about their culture (DNA)
- Know the subcontract language by heart
 - You can generally bet the subcontractor will, usually one of our weaknesses
- Nail down everything you can and make effective use of SHALLs
 - Be exact on what's required
- Make effective use of Award Fee
 - Motivate good behavior, discourage bad
- Limit “work share” arrangements, if you can
 - Split work based on strengths and competencies, not on percentages
- Be clear on “roles and responsibilities”
 - Will they be treated as a Partner or Sub?
- Don't hesitate to intervene when necessary
 - The prime is ultimately responsible
 - If it doesn't seem like it's getting better it probably isn't
- Work corporate relationships to bring added pressures to bare

Today's Problems

- NPOESS
 - Managed by two Government Organizations
 - Users and Payees cannot agree
 - Paperwork to administer changes is horrendous
 - Government Furnished Equipment
 - Incomplete handoff



MISMANAGED ACQUISITION PROCESS

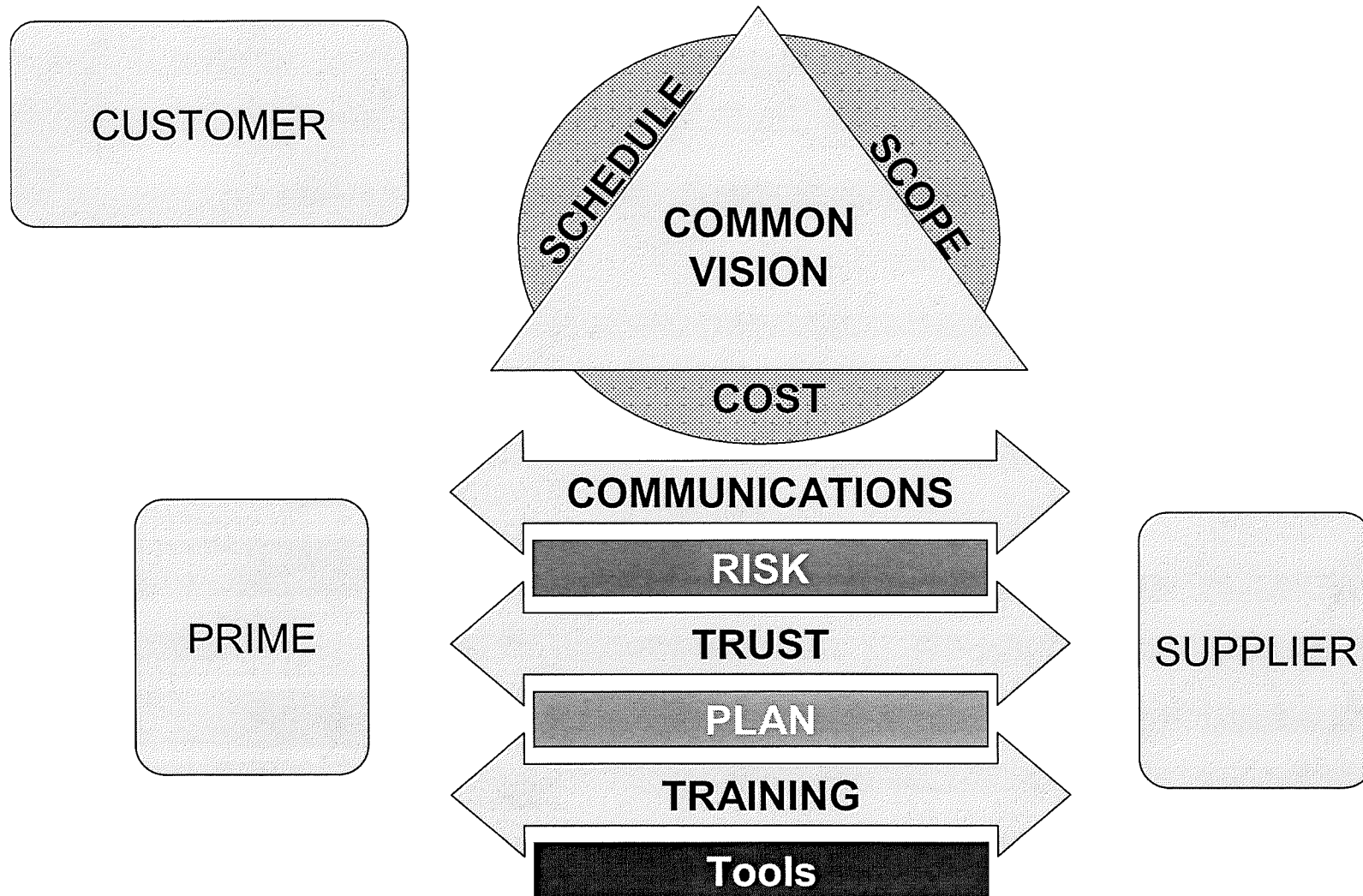
- Systemic Issue with Government Acquisitions
- Priced to Win Strategy
- No stable funding
- Requirements are volatile
- Changing Schedule

Areas of Cost Growth

- 21 percent of cost growth was due to demanding performance requirements.
- 21 percent of overruns was caused by funding delays and cutbacks.
- 18 percent of overruns resulted from inaccurate government cost estimates.
- 15 percent of overruns reflected flaws in the acquisition process.
- 13 percent resulted from distortions caused by the competitive dynamic among contractors.
- 10 percent of cost growth was caused by high turnover or inadequate skills in the public and private-sector workforce.

And the remaining two percent resulted from "industrial base" considerations.

•TO DELIVER A HIGH QUALITY PRODUCT AND ACHIEVE HIGH CUSTOMER SATISFACTION



Special Thanks
In alphabetical order
Dr. Frederick Brown
Loyola Marymount
Director of System Engineering

Steve Hixson
Northrop Grumman
Programs Directorate

Dr. Bo Oppenheim
Loyola Marymount
Director of Mechanical Engineering

Michael Narigon
Northrop Grumman
System Engineering

Dr. Rachel Katz
Loyola Marymount
Director of Masters of Business Administration

Jim Myers

Raymond Crew
Northrop Grumman
Acquisition Manager of a Ma

Dr. Arnold J. Galloway
Loyola Marymount
Graduate Division

BACK UP SLIDES

Top 5 U.S. Defense Contractor 2005

Rank	Name	Defense Revenue (US \$ million)	% of total revenue
1	Lockheed Martin	34,050	95.8
2	Boeing	30,464	58.1
3	Northrop Grumman	22,126	74.0
4	Raytheon	18,771	92.7
5	General Dynamics	15,000	78.2

Source: www.defensenews.com

Today's Space Manufacturing

- Before
 - Management of Suppliers was viewed as top down
 - Cost was the main driver of selection
- Today
 - Suppliers are viewed as partners critical to the supply chain and product development

Major Space Corporations are focusing on their core competencies and becoming major system integrators.